

ANALYSIS OF Laterally Loaded Long or Intermediate
Drilled Shafts of Small or Large
Diameter in Layered Soil

(FINAL)

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ABSTRACT

Strain wedge (SW) model formulation has been used, in previous work, to evaluate the response of a single pile or a group of piles (including its pile cap) in layered soils to lateral loading. The SW model approach provides appropriate prediction for the behavior of an isolated pile and pile group under lateral static loading in layered soil (sand and/or clay). The SW model analysis covers the entire range of soil strain or pile deflection that may be encountered in practice. The method allows development of p-y curves for the single pile based on soil-pile interaction by considering the effect of both soil and pile properties (i.e. pile size, shape, bending stiffness, and pile head fixity condition) on the nature of the p-y curve.

This study has extended the capability of the SW model in order to predict the response of laterally loaded large diameter shafts considering 1) the influence of shaft type (long, intermediate or short) on the lateral shaft response; 2) the nonlinear behavior of shaft material (steel and/or concrete) and its effect on the soil-shaft-interaction; 3) developing (partial or complete) liquefaction in the surrounding soil profile based on far- and near-field induced porewater pressure; and 4) vertical side shear resistance along the shaft wall that has a significant contribution to the lateral shaft response.

The incorporation of the nonlinear behavior of shaft material, soil liquefaction and vertical side shear resistance has a significant influence on the nature of the calculated p-y curves and the associated t-z curves. Contrary to the traditional Matlock-Reese p-y curve that was established for small diameter long (slender) piles and does not account for soil liquefaction and the variation in the shaft bending stiffness, the current approach for large diameter shafts can provide the p-y curve based on varying liquefaction conditions, vertical and horizontal shear resistance along the shaft, and the degradation in shaft flexural stiffness. In addition, the technique presented allows the classification and the analysis of the shaft as long, intermediate or short based on soil-shaft interaction.